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CERTIFICATE OF TRANSLATION

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11-26, Marunouchi 2-chome, Naka-ku, Nagoya-shi, Aichi-ken, Japan, hereby certify that to the best of my knowledge and belief the attached English translation is a true and correct translation of the original document – Japanese Patent Application No. 2002-375077 – made by me.

This 6th day of July, 2004

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2002-373077

[Name of the Document] Specification

[Title of the Invention] Occupant Protection Device

[Claims]

[Claim 1]

An occupant protection device comprising a knee-protecting airbag device located in front of an occupant seated in a front passenger's seat for protecting the occupant's knees in the event of collision of the vehicle, and a container box located above the knee-protecting airbag device for housing goods,

the knee-protecting airbag device comprising an airbag inflatable for protecting the occupant's knees, an inflator for supplying inflation gas to the airbag, a case for housing the folded airbag and the inflator, the case being opened rearward, and an airbag cover covering an opening of the case, the airbag cover being openable upon airbag inflation, wherein:

the container box includes a bottom wall supporting the goods by a top surface thereof, the bottom wall being arranged obliquely such that a front edge of the bottom wall is disposed downward in relation to a rear edge of the bottom wall;

the case includes a circumferential wall portion surrounding the opening, and a back wall arranged at a front region and apart from the opening; and

a rear region of an upper wall of the circumferential wall portion extends generally along the bottom wall.

[Claim 2]

The occupant protection device as set forth in claim 1, wherein:

the container box has a box-shape and includes a rear wall extending upward from the rear edge of the bottom wall and exposed from a surrounding

interior decoration member, a front wall extending upward from the front edge of the bottom wall, side walls extending upward from left and right edges of the bottom wall, and an opening at the top for housing the goods; and

the container box has a rotation center in a lower region thereof, and rotates rearward about the rotation center such that the opening is drawn from the interior decoration member to open toward the interior of vehicle.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a vehicle occupant protection device located in front of a front passenger's seat for protecting knees of an occupant seated in the front passenger's seat.

[0002]

[Description of Related Art]

In the prior art, the patent publication 1, for example, shows a device for protecting knees of a vehicle occupant seated in a front passenger's seat which device includes an inflatable airbag for protecting occupant's knees.

[0003]

[Patent Publication 1]

JP 8-80797 A

[0004]

[Problems to be solved by the invention]

However, there is conventionally disposed a container box (or glove box) for housing a car registration, a map and so on in front of the front passenger's seat.

[0005]

In front of the front passenger's seat, a space for legs of the occupant is also required. Accordingly, when it is desired to mount a knee-protecting airbag device in front of the front passenger's seat, the container box is forced to have a limited capacity for housing goods. For example, it has been difficult to house an A4 sized atlas in the container box.

[0006]

The present invention contemplates to solve the above problem, and therefore, has an object to provide an occupant protection device which allows the container box to have an enough housing space to house large goods even if a container box is mounted in front of the front passenger's seat while the device aims to protect knees of the occupant seated in the front passenger's seat.

[0007]

[Means of Solving the Problem]

The occupant protection device of the present invention includes a knee-protecting airbag device located in front of an occupant seated in a front passenger's seat for protecting the occupant's knees in the event of collision of the vehicle, and a container box located above the knee-protecting airbag device for housing goods. The knee-protecting airbag device includes an airbag inflatable for protecting the occupant's knees, an inflator for supplying inflation gas to the airbag, a case for housing the folded airbag and the inflator, the case being opened rearward, and an airbag cover covering an opening of the case, the airbag cover being openable upon airbag inflation. The container box includes a bottom wall supporting the goods by its top surface, and the bottom wall is so arranged obliquely that its front

edge is disposed downward in relation to its rear edge. The case includes a circumferential wall portion surrounding the opening and a back wall arranged at the front region and apart from the opening. A rear region of an upper wall of the circumferential wall portion extends generally along the bottom wall.

[0008]

In the occupant protection device embodying the present invention, the bottom wall of the container adapted to support housed goods is slanted so that its front edge is located in a lower level with respect to its rear edge. That is, the bottom wall is disposed in an upper level in comparison with a case where no knee-protecting airbag device is mounted below the container box. However, as much as the front edge is lowered, the container box secures its capacity. For example, a sheet-shaped goods such as an A4 sized atlas, which would be still bulky if it is turned sideways, will be easily housed in the container box without bending, if the goods is obliquely housed in the container box such that an upper end part of the goods is located in a rear upper region of the container box whereas a lower end part is located toward the front edge of the bottom wall, because the dimension between the rear upper region of the container box and the front edge of the bottom wall by that the front edge of the bottom wall is disposed downward with respect to the rear edge.

[0009]

In the case of the knee-protecting airbag device, the rear region of the upper wall of the circumferential wall portion extends obliquely upward toward the rear generally along the inclination of the bottom wall in which the front edge is lower than the rear edge or the rear edge is upper than the front edge. Accordingly, when the airbag fed

with inflation gas opens the airbag cover and protrudes from the case, the airbag is guided by the rear region of the upper wall of the circumferential wall portion and protrudes obliquely upward along the rear face of the container box. Thus the airbag smoothly develops and completes inflation without engaging knees of an occupant if a clearance between the container box and the knees is narrow.

[0010]

In the occupant protection device of the present invention, therefore, although the container box is mounted in front of the front passenger's seat while the device aims to protect knees of the occupant seated in the front passenger's seat, the container box has an enough housing space for housing large goods. In addition, even if a clearance between the container box and the occupant's knees is narrow, its airbag smoothly deploys without engaging the knees.

[0011]

If the container box has a box-shape and includes a rear wall extending upward from the rear edge of the bottom wall and exposed from a surrounding interior decoration member, a front wall extending upward from the front edge of the bottom wall, side walls extending upward from left and right edges of the bottom wall, and an opening at the top for housing the goods, and if the container box has a rotation center in its lower region, and rotates rearward about the rotation center such that the opening is drawn from the interior decoration member to open toward the interior of vehicle, the following working-effects are obtained.

[0012]

When the sheet-shaped goods B such as an A4 sized atlas, which would be still bulky if it is turned sideways, is obliquely housed in

the container box such that its upper end part is located in the rear upper region of the container box whereas its lower end part is located toward the front edge of the bottom wall, if the container box is rotated rearward to open the opening toward the interior, the goods merely rotates while keeping the housed state. Accordingly, the goods is prevented from jumping out of the container box.

[0013]

If the container box includes a box body for housing goods and being secured to the vehicle, an opening at the rear of the box body, and a lid for opening/closing the opening, if the lid is opened on the condition that a sheet-shaped goods B such as an A4 sized atlas is obliquely housed in the box body such that its upper end part is located in the rear upper region of the box body whereas its lower end part is located toward the front edge of the bottom wall of the box body, the upper end part of the goods will turn down rapidly along with the opening of the lid, and the goods may hit the lower end vicinity of the lid near a hinge region of the lid or the rear edge vicinity of the bottom wall and lose a balance. Therefore, the goods is likely to jump out of the box body, and the opening of the lid requires a caution when the box contains large goods.

[0014]

[Mode for Carrying out the Invention]

An embodiment of the present invention will be described with reference to drawings. As shown in Figs. 1 to 3, an occupant protection device S embodying the present invention includes a knee-protecting airbag device 11, a container box 60, and a lower panel 8 surrounding a rear side face of the container box 60 and serving as an interior decoration member. The knee-protecting airbag device 11 is located

in front of an occupant M seated in a front passenger's seat PS for protecting knees K (KL and KR) of the occupant M in the event of a collision of a vehicle. The container box 60 is located above the knee-protecting airbag device 11 for housing goods B.

[0015]

Front, rear, left and right in this specification are based on a condition where the occupant protection device is mounted on a vehicle, and are consistent with front, rear, left and right of the vehicle.

[0016]

Arranged in front of the front passenger's seat PS is an instrument panel 6 serving as an interior decoration member. In this embodiment, the instrument panel 6, which will be called the dashboard 6 below, is comprised of an upper panel 7 disposed in the upper side and a lower panel 8 disposed in the lower side. The lower panel 8 encircles a rear wall 63 of the container box 63. Arranged below the lower panel 8 and the rear wall 63 is an airbag cover 44 of the knee-protecting airbag device 11.

[0017]

An airbag device 80 for a front passenger's seat is arranged in a region of the upper panel 7 for protecting the breast and so on of the upper body MU of the occupant M in the event of a frontal collision of vehicle. The airbag device 80 for a front passenger's seat includes an inflatable airbag 81 for protecting the breast and so on of the upper body MU of the occupant M, an inflator 82 for feeding the airbag 81 with inflation gas, an airbag cover 83 covering the folded airbag 81 in such a manner as to allow the airbag 81 to deploy upon airbag inflation, and a case 84 for housing the folded airbag 81 and the inflator 82 and holding the airbag cover 83. The airbag device 80 is bolt 85 fixed

to a bracket 2a formed in a dashboard reinforcement 2 of the vehicle body 1. The bolt 85 is fastened with a nut 2b fixed to the bracket 2a.

[0018]

As shown in Figs. 1, 3 and 10, the lower panel 8 includes an opening 8a for housing the container box 60. The lower panel 8 also includes an accommodation wall 9 projecting forward from the edge of the opening 8a in a reversed U shape. In a lower region of each of side walls 9a of the accommodation wall 9 which side walls confront in the left-side direction is a pivot hole (or a rotation center) 9b for supporting a pivot pin (or a rotation center) 68 of the container box 60 (or a box body 61) in the open/close operation. In an upper region of each of the side walls 9a is a guide hole 9c adapted to guide a guide pin 67 of the container box 60 (or a box body 61) in the open/close operation. Each of the guide holes 9c has an arcuate shape bulging upward, and is provided in its inner circumference with a projection 9d for releasably stopping the guide pin 67 and holding the box body 61 in position when the box body 61 is housed inside the lower panel 8 and the opening 69 of the box body 61 is closed.

[0019]

The lower panel 8 is provided at the front side in the upper periphery with a plurality of mounting members 8d for joinder with the upper panel 7. The mounting members in the embodiment are retaining legs 8d to hook the edge of the upper panel 7. The lower panel 8 is further provided at the front side in the left and right lower edge regions with fixing members 8b projecting to be fixed by a case 12 of the knee-protecting airbag device 11. A fixing hole 8c is formed through each of the fixing members 8b.

[0020]

As shown in Figs. 2 to 4, 10 and 13, the container box 60 is comprised of a box body 61 made from synthetic resin and having a box-shape opening upward. The box body 61 includes a bottom wall 62 having a generally rectangular plate shape and adapted to support goods (Fig. 4) by its top face 62e, a rear wall 63 extending upward from the rear edge 62b of the bottom wall 62 and exposed to the interior of vehicle from the opening 8a of the lower panel 8 serving as the interior decoration member, a front wall 64 extending upward from the front edge 62a of the bottom wall 62, and left and right side walls 65 and 66 each extending upward from left and right edges 62c and 62d of the bottom wall 62, thus providing the opening 69 for housing goods B at the top.

[0021]

When the box body 61 is so housed inside the lower panel 8 as to close the opening 69, the bottom wall 62 is slanted in such a manner as to dispose the front edge 62a in a lower level relative to the rear edge 62b.

[0022]

In comparison with the location of a conventional container box, as shown in Fig. 2, the front edge 62a is located in a slightly upper position whereas the rear edge 62b is in an upper position by as much as an amplified space H for the legs F of the occupant M below the knee-protecting airbag device 11.

[0023]

The left and right side walls 65 and 66 of the box body 61 each includes a pivot pin 68 in the lower region which pin protrudes to serve as the rotation center, and a guide pin 67 projecting in the upper region. Each of the guide pins 67 is inserted into the guide hole 9c of the

lower panel 8, whereas each of the pivot pin 68 is set in the pivot hole 9b serving as the rotation center of the lower panel 8. In the box body 61, the opening 69 is drawn from the lower panel 8 to open into the interior of vehicle by the rearward rotating operation about the pivot pin 68. The open/close position of the opening 69 of the box body 61 is determined by the guide hole 9c. However, the open/close position of the opening 69 of the box body 61 may be determined by a stopper pin or a supporting member formed in the lower panel 8 or the case 12 abutting against or supporting the bottom wall 62 of the box body 61.

[0024]

As shown in Figs. 3, 6 and 7, the knee-protecting airbag device 11 in the occupant protection device S according to the embodiment includes a folded airbag 39, an inflator 31 for feeding the airbag 39 with inflation gas, a case 12 opened rearward for housing the folded airbag 39 and the inflator 31, and an airbag cover 44 for covering the vehicle's rear side of the case 12.

[0025]

The inflator 31 is a cylinder-type arranged so that its axial direction may be along the vehicle's left-right direction. The inflator 31 includes a substantially columnar body 32 and a diffuser 33. The body 32 includes a substantially columnar general portion 32a and a small diameter portion 32b projected from an end face of the general portion 32a. There are formed a plurality of gas discharge ports 32c on the outer circumference of the small diameter portion 32b. A connecter 36 to which a lead wire 37 is connected for inputting actuating signals is connected to the other end face of the general portion 32a away from the small diameter portion 32b. The diffuser 33 has a

substantially cylindrical shape for covering the inflator body 32. The diffuser 33 is provided at the rear side as mounted on the vehicle with a plurality of gas outlet ports 33a for emitting inflation gas. The diffuser 33 further includes a plurality (two, in the foregoing embodiment) of bolts 33d protruded forward of the vehicle, and a plurality of clamping portions 33c for holding the body 32. To attach the inflator body 32 to the diffuser 33, the body 32 is inserted into the diffuser 33 through an insert hole 33b, from the small diameter portion 32b. Then each of the clamping portions 33c is plastically deformed and pressed onto the outer circumference of the general portion 32a. Thus the body 32 is secured to the diffuser 33. If each of the bolts 33d is inserted into a through hole 17a of a back wall 17 of the case 12, and then nut 34 is fastened with the bolt 33d, the inflator 31 is secured to the case 12.

[0026]

The inflator 31 is actuated by an actuating signal inputted through the lead wire 37 when an airbag actuating circuit mounted on the vehicle detects a frontal collision of the vehicle. When the actuating circuit detects a frontal collision of the vehicle, the inflator 82 of the airbag device 80 for a front passenger's seat also receives an actuating signal simultaneously.

[0027]

The airbag 39 is formed of flexible woven fabric of polyester, polyamide or the like, and takes a substantially rectangular plate shape as deployed completely, as indicated by double-dotted lines in Figs. 1 to 3. The airbag 39 is transversely wide enough to protect both knees KL and KR of the occupant M. The airbag 39 is configured to locate its occupant's side wall 40 toward the occupant M, and locate its vehicle

body side wall 41 toward the container box 60 when completely deployed. The walls 40 and 41 have substantially the same shape as each other, and are joined to each other by tethers 43 so the airbag 39 is kept in a generally plate shape during inflation, as shown in Figs. 4 and 11. The airbag 39 is provided in a region 42 in the vehicle body side wall 41 or at its lower edge 39d region as completely deployed with insert holes 42a and an insert hole 42b, as shown in Figs. 4 and 12. The insert holes 42a are for inserting through the individual bolts 33 of the inflator 31, and the insert hole 42b is for inserting through the body 32 of the inflator 31. The airbag 39 is attached to the case 12 with the body 32 of the inflator 31 protruded from the insert hole 42b, and with the periphery of the individual insert holes 42a clamped by the diffuser 33 and the back wall 17 of the case 12. In other words, the airbag 39 is secured to the back wall 17 of the case 12 by the periphery of the insert holes 42a serving as a mounting portion 42.

[0028]

As shown in Figs. 4 to 7 and 10, the case 12 is made of sheet metal and includes a box-shaped body 13 having a generally rectangular opening 13a at the rear side, and a panel portion 18 extending outward from a rear end of the body 13. The case 12 is disposed directly below the bottom wall 62 of the container box 60 in the closed position. The body 13 includes a circumferential wall portion 14 having a substantially square cylindrical shape and encircling the opening 13a, and a back wall 17 located apart from the opening 13a and closing vehicle's front side of the circumferential wall portion 14.

[0029]

The axial direction X of the circumferential wall portion 14 extending from the back wall 17 to the opening 13a extends obliquely

upward toward the rear in such a manner as to extend along the bottom wall 62 of the closed box body 61. A top wall 14a positioned at the top of the circumferential wall portion 14 expands along the bottom wall 62 at its rear region 14ab.

[0030]

The circumferential wall portion 14 is provided on the outer surfaces of its walls 14a and 14b which confronts each other in the vertical direction with a plurality of retainers 15 (15U and 15D) for attaching upper and lower joint walls 47 and 48 of the airbag cover 44 to the case 12.

[0031]

As shown in Fig. 10, each of the retainers 15U located on the outer surface of the upper wall 14a is formed into a hook shape having substantially Z-shaped section, and is adapted to be inserted into the retaining hole 47a formed on the upper joint wall 47 of the airbag cover 44 and retained thereat. The hooks 15U are located in a plurality of positions (four positions, in the foregoing embodiment) along the transverse direction of the vehicle on the wall 14a.

[0032]

Each of the retainers 15D located on the outer surface of the lower wall 14b is formed into a projection shape having a substantially U-shaped section, and is adapted to be inserted into the retaining hole 48a of lower joint wall 48 of the airbag cover 44. The projections 15D are located in a plurality of positions (four positions, in the foregoing embodiment, refer to Fig. 10) along the transverse direction of the vehicle on the wall 14b. A locking member 16 is inserted into the projections 15D for preventing the projections 15D from coming off from the retaining holes 48a. The locking member 16 includes four bars

16a to be inserted in between the outer surface of the lower joint wall 48 and inner circumferences of the individual projections 15D. The four bars are integrated at the vehicle's front side and secured to the case 12. The locking member 16 is secured to the back wall 17 of the case 12 together with the inflator 31 when the inflator 31 is fixed to the case 12 by means of bolt 33d and nut 34.

[0033]

As shown in Fig. 7, the side wall 14c in the circumferential wall portion 14 has an insert hole 14d for inserting through the end of the body 32 of the inflator 31. In the back wall 17, there are formed two insert holes 17a for inserting through the bolts 33d of the inflator 31.

[0034]

The panel portion 18 has a substantially flat plate shape elongated in the transverse direction to encircle the opening 13a of the case 12. Here, the case 12 shown in Fig. 10 is constructed by welding two members of a box member 12a and a panel member 12b. The panel member 12b constitutes the panel portion 18, and includes the retainers 15U and 15D to be located on the outer surface of the circumferential wall portion 14 of the body 13. The case 12 is formed of two members of the box member 12a and the panel member 12b so as to reduce kinds of components by that the knee protecting airbag device for a front passenger's seat and a knee protecting airbag device for a driver's seat use the same kind of components. That is, the box member 12a of the case 12 and the inflator 31 are also used for the knee-protecting airbag device for a driver's seat, whereas the panel member 12b and the airbag cover 44 are so configured as to fit in their arrangement positions.

[0035]

The case 12 further includes two fixers 23 for fixing the lower panel 8 thereto. As shown in Figs. 9 and 10, the fixers 23 are adapted to fix the fixing pieces 8b projected downward from the vicinities of left and right lower ends of the lower panel 8 by means of tapping bolts 25. Each of the fixers 23 is provided with a hole 23a for screwing the bolt 25 into.

[0036]

As referred to Figs. 5, 8 and 10, the case 12 includes three joint sections 26 for securing the airbag device 11 to the vehicle body 1. The joint sections 26 are located in positions away from the body 13 in the panel portion 18, and includes joint sections 26A and 26B located in the vicinities of left and right upper edge, respectively, and a joint section 26C located toward right side in the lower edge. Each of the joint sections has a joint hole 26a for inserting a bolt 27 thereinto. The joint sections 26 are bolt 27 fixed to brackets 3 extending from a center brace or a side member of the vehicle body 1, thereby serving to secure the airbag device 11 to the vehicle body 1. Each of the brackets 3 in advance has a nut 3a fixed thereto for screwing the bolt 27 thereinto.

[0037]

Moreover, as referred to Figs. 5, 6 and 10, the panel portion 18 of the case 12 is provided at four positions in the upper periphery of the opening 13a with apertures 18a for inserting the upper joint wall 47 of the airbag cover 44, and at two positions near left and right edges with apertures 18b for retaining retaining legs 46 of the airbag cover 44 (Fig. 9). Apertures 18c shown in Figs. 5 and 10 are adapted to retain not-shown retaining legs of an undercover 4. Slits 18d shown in Figs. 5 and 7 are for inserting left and right side walls 49 of the

airbag cover 44 therethrough.

[0038]

In the embodiment, the upper edge of the panel portion 18 of the case 12 abuts against and supports the rear edge 62b vicinity of the bottom wall 62 of the closed box body 61, as shown in Fig. 6. However, considering a situation where the box body 61 houses heavy goods, the case 12 may also be provided with a bracket 22 for abutting against and supporting the front edge 62a vicinity of the bottom wall 62.

[0039]

The airbag cover 44 is joined to and supported by the case 12 for covering the vehicle's rear side of the folded airbag 39 and the case 12. The airbag cover 44 includes two doors 52 (an upper door 52U and a lower door 52D) covering the opening 13a of the case 12 at the rear side. The doors 52U and 52D are formed in a substantially rectangular plate shape, and are provided therearound with a thinned breakable portion 51 of a substantially H-shape as viewed from the vehicle's rear side, as shown in Fig. 1. The breakable portion 51 is so provided at its vehicle's front side face with continuous or intermittent grooves as to easily break when the doors 52U and 52D are pushed by the inflating airbag 39. Thus the doors 52U and 52D are configured to open upward and downward about integral hinges or hinge lines 53 which are arranged in positions connecting upper ends and lower ends of left and right vertical lines of an H-shape of the breakable portion 51 if the breakable portion 51 breaks when pushed by inflating airbag 39.

[0040]

In the vicinity of the periphery of the doors 52U and 52D, there are formed four walls 47, 48, 49 and 49 protruded forward of the vehicle

to neighbor the circumferential wall portion 14 of the case 12 from the out side, as shown in Figs. 6, 7 and 10. The upper joint wall 47 located above the case circumferential wall 14 and the lower joint wall 48 located below the wall 14 serve to join the airbag cover 44 to the case 12. The walls 47 and 48 include retaining holes 47a and 48a, respectively, such that the retainers 15 (15U and 15D) of the circumferential wall portion 14 are inserted and retained thereat. The retaining holes 47a and 48a each has a rectangular shape.

[0041]

A general section 45 is arranged in the left and right sides of the doors 52, and covers the rear side of the panel portion 18 of the case 12. The general section 45 includes retaining legs 46 at left and right sides in the lower edge. The retaining legs 46 are protruded forward of the vehicle to be inserted into the apertures 18b of the panel portion 18 and retained by the panel portion 18, as shown in Figs. 9 and 10.

[0042]

To mount the occupant protection device S on the vehicle, the airbag 39 and the inflator 31 are firstly housed in the case 12 of the knee-protecting airbag device 11. More specifically, as shown in Figs. 11 and 12A, the inflator 31 preliminarily assembled by the body 32 and the diffuser 33 is put in the airbag 39 so that the bolts 33d are protruded from the insert holes 42a and the end of the inflator body 32 is protruded from the insert hole 42b, and then the airbag 39 is folded up.

[0043]

The folding of the airbag 39 is conducted as follows: Firstly, as shown in Figs. 12A and 12B, the airbag 39 is so flattened that the occupant side wall 40 and the vehicle body side wall 41 are overlaid

one on the other. Then left and right edges 49a and 39b of the airbag 39 are folded back onto the occupant's side wall 40, and then as shown in Figs. 12B and 12C, the airbag 39 is rolled from the upper edge 39c toward the lower edge 39d at the side of the vehicle body side wall 41, thereby forming a roll-folded portion 39e. Thereafter, left and right end regions 39e are folded back below the roll-folded portion 39e, and thus the folding work of the airbag 39 is completed.

[0044]

Subsequently, the airbag 39 is wrapped by a not-shown breakable wrapping film for keeping the folded-up shape. At this time, the bolts 33d and the end of the body 32 of the inflator 31 protruded from the insert holes 42a and 42b are taken out from the wrapping film. Other than a resin sheet member, a cloth member such as the woven fabric used to form the airbag 39, a tape member or a string member may be employed as the wrapping film.

[0045]

Thereafter, the inflator 31 is housed in the case 12 together with the folded airbag 39, so that the individual bolts 33d of the inflator 31 are protruded from the insert holes 17a, and the end of the inflator body 32 is protruded from the insert hole 14d. By further fastening not-shown spring nuts with the individual bolts 33d from the front side of the bottom wall 17, the inflator 31 and the airbag 39 are housed in and attached to the case 12. A connector 36 having the lead wire 37 connected thereto is preliminarily joined with the body 32 of the inflator 31.

[0046]

Subsequently, the airbag cover 44 is assembled with the case 12. To assemble the airbag cover 44 with the case 12, the walls 47, 48 and

49 of the airbag cover 44 are located around the circumferential wall portion 14 of the case toward the opening 13a. The retaining hooks 15U are then so inserted into the retaining holes 47a of the upper joint wall 47 as to be retained at peripheries of the retaining holes 47a on the upper surface of the upper joint wall 47. On the other hand, the retaining projections 15D are inserted into the retaining holes 48a of the lower joint wall 48, and the retaining legs 46 are so inserted into the apertures 18b as to be retained at peripheries of the apertures 18b. Subsequently, the bars 16a of the locking member 16 are inserted between the outer surface of the lower joint wall 48 and the inner circumference of the individual projections 15D, the individual bolts 33d of the inflator 31 are inserted through the locking member 16, and then the nuts 34 are fastened with the bolts 33d. Thus the airbag cover 44 is joined with the case 12.

[0047]

If then the bolts 27 are fastened into the nuts 3a through the joint holes 26a, the joint sections 26 of the case 12 are secured to the vehicle body 1, and the knee-protecting airbag device 11 is mounted on the vehicle. The end of lead wire 37 is connected to a predetermined airbag actuating circuit.

[0048]

In the meantime, the box body 61 is assembled with the lower panel 8 by setting the box body 61 in the inner circumference of the accommodation wall 9 inside the opening 8a of the lower panel 8, and inserting the pivot pins 68 and guide pins 67 into the pivot holes 9b and guide holes 9c. Furthermore, the retaining legs 8d are retained by the upper panel 7, and the fixing pieces 8b of the lower panel 8 are bolt 25 fixed to the fixers 23 of the case 12. Then attachment

of the under cover 4 finalizes the mounting work of the container box 60 on the vehicle, and the mounting work of the occupant protection device S on the vehicle. The upper panel 7 of the instrument panel 6 and the airbag device 80 for a front passenger's seat are mounted on the vehicle by the time of mounting the lower panel 8 and the container box 60 on the vehicle.

[0049]

In the embodiment, when it is desired to use the container box 60, if a predetermined knob 63 is gripped and pulled rearward, the box body 61 rotates rearward about the pivot pins 68 serving as the rotation center, and the opening 69 are drawn from the lower panel 8 to open for housing goods B inside the box body 61. If the box body 61 is made to rotate forward thereafter, the box body 61 is put away inside the lower panel 8 in order to close the opening 69 (Fig. 4).

[0050]

In the foregoing embodiment, the bottom wall 62 of the container box 60 which wall 62 is adapted to support housed goods B is slanted so that its front edge 62a is located in a lower level with respect to its rear edge 62b. That is, the bottom wall 62 is disposed in an upper level in comparison with a case where the vehicle is not equipped with a knee-protecting airbag device 11. However, as much as the front edge 62a is lowered, the container box 60 is capable of securing its capacity. For example, a sheet-shaped goods B such as an A4 sized atlas, which goods B would be still bulky if it is turned sideways, will be easily housed in the container box 60 without bending. More specifically, if the goods B is obliquely housed in the container box 60 such that an upper end Bu part of the goods B is located in a rear upper region 60a of the container box 60 whereas a lower end Bd part is located toward

the front edge 62a of the bottom wall 62, it is housed in the container box 60, because a dimension L (Fig. 4) between the rear upper region 60a of the container box 60 and the front edge 62a of the bottom wall 62 by that the front edge 62a of the bottom wall 62 is disposed downward with respect to the rear edge 62b.

[0051]

When an actuating signal is input to the body 32 of the inflator 31 via the lead wire 37, inflation gas is discharged from the gas discharge ports 32c of the inflator 31, and flows into the airbag 39 via the gas outlet ports 33a of the diffuser 33. Then the airbag 39 inflates and breaks the wrapping film, pushes the doors 52 (52U and 52D) of the airbag cover 44, and breaks the breakable portion 51 to open the door 52U upward and 52D downward, respectively about the hinge lines 53. As indicated by double-dotted lines in Figs. 2 to 4, the airbag 39 then protrudes rearward from the opening 54 provided by the opening of the doors 52U and 52D, and further protrudes upward along the rear surface 60b of the rear wall 63 of the box body 61 while expanding and inflating. Accordingly, even if the occupant M seated in the front passenger's seat advances, the inflated airbag 39 is capable of protecting the knees K properly.

[0052]

At this time, since the airbag device 80 for front passenger's seat is actuated, too, the airbag 81 protrudes from the dashboard 6 to protect the upper body MU of the occupant M, as indicated by double-dotted lines in Fig. 2.

[0053]

Especially in the embodiment, in the case 12 of the knee-protecting airbag device 11, the rear region 14ab of the upper wall 14a of the

circumferential wall portion 14 extends obliquely upward toward the rear generally along the inclination of the bottom wall 62 in which the front edge 62a is lower than the rear edge 62b or the rear edge 62b is upper than the front edge 62a. Accordingly, when the airbag 39 fed with inflation gas opens the doors 52U and 52D of the airbag cover 44 and protrudes from the case 12, the airbag 39 is guided by the rear region 14ab of the upper wall 14a of the circumferential wall portion 14 and protrudes obliquely upward along the rear face 60b of the container box 60. Thus the airbag 39 smoothly develops and completes inflation without engaging the knees K of the occupant M if a clearance between the container box 60 and the knees K is narrow.

[0054]

Especially in the embodiment, the lower wall 14b of the circumferential wall portion 14 also extends along the rear region 14ab of the upper wall 14a. That is, the axial direction X of the circumferential wall portion 14 itself extending from the back wall 17 to the opening 13a extends obliquely upward toward the rear in such a manner as to extend along the bottom wall 62 of the closed box body 61. Accordingly, when the airbag 39 opens the doors 52U and 52D of the airbag cover 44 and protrudes from the case 12, the airbag 39 is guided by the whole inner circumference of the circumferential wall portion 14 including the upper wall 14a and lower wall 14b and protrudes obliquely upward along the rear face 60b of the container box 60. Thus the airbag 39 smoothly develops and completes inflation without engaging the knees K of the occupant M if the clearance between the container box 60 and the knees K is narrow.

[0055]

In the embodiment, furthermore, the airbag 39 in the housed state

is roll-folded, or folded by such a folding method as to bring the upper edge 39c of the airbag 39 close to the lower edge 39d at the side of the vehicle body side wall 41 which folding method facilitates the airbag deployment along the rear face 60b. Accordingly, the airbag 39 smoothly develops and completes inflation without engaging the knees K of the occupant M if the clearance between the container box 60 and the knees K is narrow.

[0056]

Therefore, the occupant protection device S of the embodiment allows the container box 60 to have an enough housing space to house large goods B even if the container box 60 is mounted in front of the front passenger's seat while the device aims to protect knees K of the occupant M seated in the front passenger's seat. Moreover, in the device S, the airbag 39 smoothly deploys without engaging the knees K of the occupant M if the clearance between the container box 60 and the knees K is narrow.

[0057]

In the embodiment, furthermore, the container box 60 is comprised of a box-shaped box body 61 including the rear wall 63 extending upward from the rear edge 62b of the bottom wall 62 and exposed to the interior of vehicle from the lower panel 8 serving as the interior decoration member, the front wall 64 extending upward from the front edge 62a of the bottom wall 62, the side walls 65 and 66 extending upward from left and right edges 62c and 62d of the bottom wall 62, and the opening 69 at the top for housing goods B. Besides, the box body 61 has a rotation center in its lower region, and rotates rearward about the rotation center such that the opening 69 is drawn from the lower panel 8 to open toward the interior of vehicle.

[0058]

Accordingly, when the sheet-shaped goods B such as an A4 sized atlas, which would be still bulky if it is turned sideways, is obliquely housed in the container box 60 such that its upper end Bu part is located in the rear upper region 60a of the container box 60 whereas its lower end Bd part is located toward the front edge 62a of the bottom wall 62, if the container box 60 is rotated rearward to open the opening 69 toward the interior, i.e., if the container box 60 shown in Fig. 4 is moved to the state indicated by solid lines in Fig. 13, the goods B merely rotates while keeping the housed state. Accordingly, the goods B is prevented from jumping out of the container box 60.

[0059]

Without considering above point, a construction of a container box 60A shown in Figs. 14 and 15 may be adopted. In the container box 60A, a box body 61A for housing goods B is secured to the vehicle by a bracket 2c or the like. The box body 61A includes a bottom wall 62 whose front edge 62a is disposed downward in relation to the rear edge 62b, an opening 69 at the rear, and a lid 71 for opening/closing the opening 69. The lid 71 is provided at left and right lower edge vicinities in the front side with hinge arms or a rotation center 72 rotatably supported by pivot sections or a rotation center 28 of the panel portion 18 of the case 12, thereby opens/close the opening 69. In the box body 60A, if the lid 71 is opened on the condition that a sheet-shaped goods B such as an A4 sized atlas is obliquely housed in the box body 61A such that its upper end Bu part is located in the rear upper region 60a of the box body 61A whereas its lower end Bd part is located toward the front edge 62a of the bottom wall 62 of the box body 61A, the upper end Bu part of the goods B will turn down rapidly along with the opening

of the lid 71, and the goods B may hit the lower end vicinity of the lid 71 near the rotation center 72 or the rear edge 62b vicinity of the bottom wall 62 and lose a balance. Therefore, the goods B is likely to jump out of the box body 61A, and the opening of the lid 71 requires a caution when the box contains large goods.

[0060]

Although the embodiment has shown the rotatable box body 61 supported by the lower panel 8, the box body 61 may also be supported by a rigid rotation center or pivot section 28 which is made of sheet-metal and formed in the case 12, as shown in Figs. 14 and 15. Further alternatively, the lid 71 shown in Figs. 14 and 15 may also be supported by the box body 71 or the lower panel 8.

[Brief Description of the Drawings]

Fig. 1 is a front view of an occupant protection device embodying the present invention as mounted on the vehicle, as viewed from rearward of the vehicle;

Fig. 2 is a schematic vertical section of the occupant protection device of the embodiment as mounted on the vehicle, taken along the front-rear direction of the vehicle;

Fig. 3 is a schematic enlarged vertical section of the occupant protection device of the embodiment as mounted on the vehicle, taken along the front-rear direction of the vehicle;

Fig. 4 is a schematic and further enlarged vertical section of the occupant protection device of the embodiment taken along the front-rear direction of the vehicle;

Fig. 5 is a front view of the occupant protection device of the embodiment as viewed from rearward and slightly upward;

Fig. 6 is a schematic enlarged vertical section of a

knee-protecting airbag device of the embodiment;

Fig. 7 is a schematic enlarged cross section of the knee-protecting airbag device of the embodiment;

Fig. 8 is a schematic vertical section showing the joined condition of the knee-protecting airbag device of the embodiment and the vehicle body, taken along the line VIII-VIII in Fig. 5;

Fig. 9 is a schematic vertical section showing the joined condition of a lower panel and a case of the embodiment, taken along the line IX-IX in Fig. 5;

Fig. 10 is an exploded perspective view of a container box and the case of the knee-protecting airbag device of the embodiment;

Fig. 11 is a development of an airbag of the knee-protecting airbag device of the embodiment having an inflator housed therein;

Fig. 12 illustrates folding processes of the airbag of the knee-protecting airbag device of the embodiment;

Fig. 13 is a schematic section showing the open/close operation of the container box of the embodiment;

Fig. 14 is a schematic section of a modification of the container box; and

Fig. 15 is an exploded perspective view of the container box of Fig. 14 and a case.

[Description of the Reference Numerals]

8 … (interior decoration member) lower panel

11 … knee-protecting airbag device

12 … case

14 … circumferential wall portion

14a … upper wall

14ab … rear region (of the upper wall)

17 … back wall

13a … opening

31 … inflator

39 … airbag

44 … airbag cover

60 … container box

61 … box body

62 … bottom wall

62a … front edge

62b … rear edge

63 … rear wall

64 … front wall

65, 66 … side wall

69 … opening

X … axial direction (of the circumferential wall portion of the case)

PS … front passenger's seat

M … vehicle occupant

K (KL, KR) … knee

B … goods

S … occupant protection device

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Fig. 1

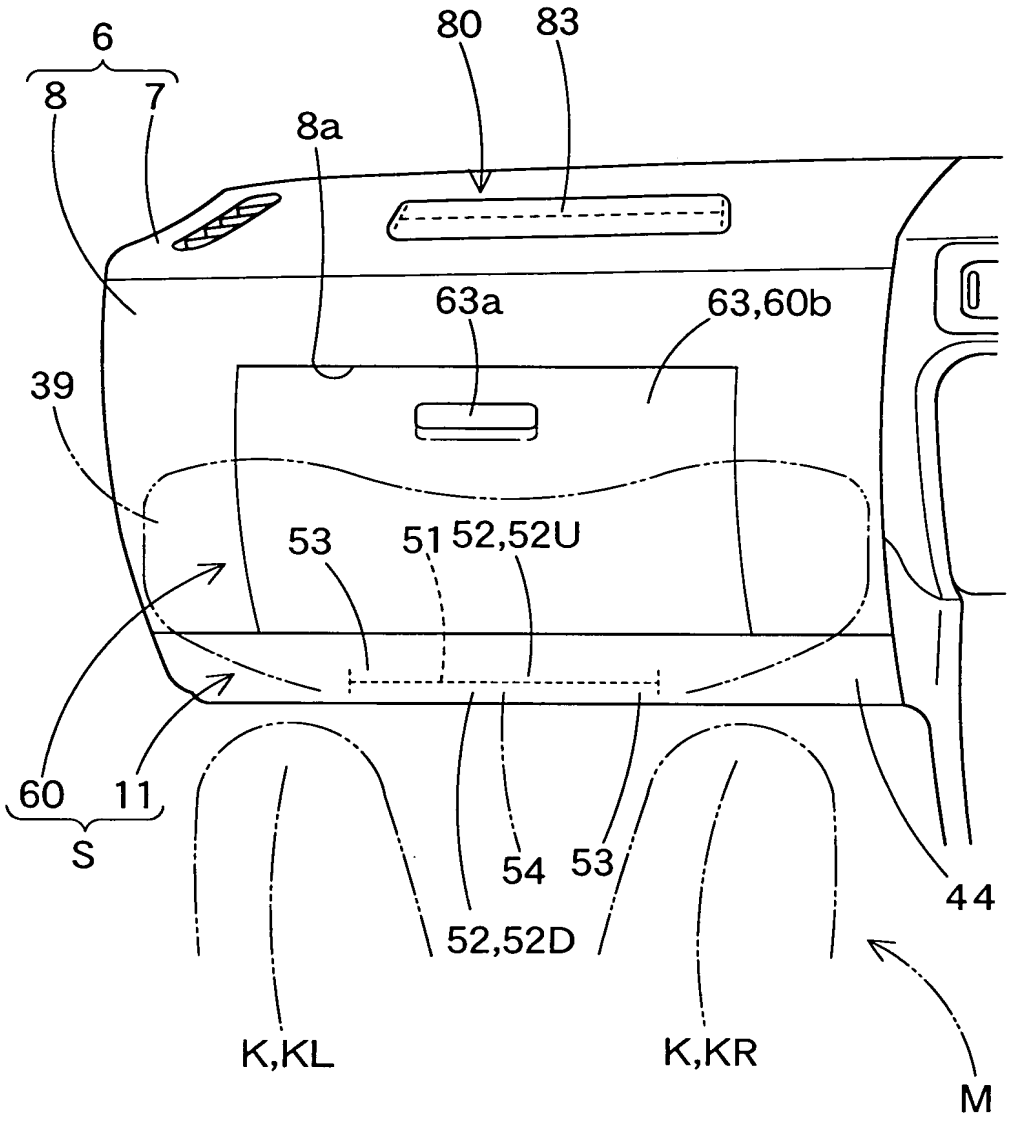


Fig. 2

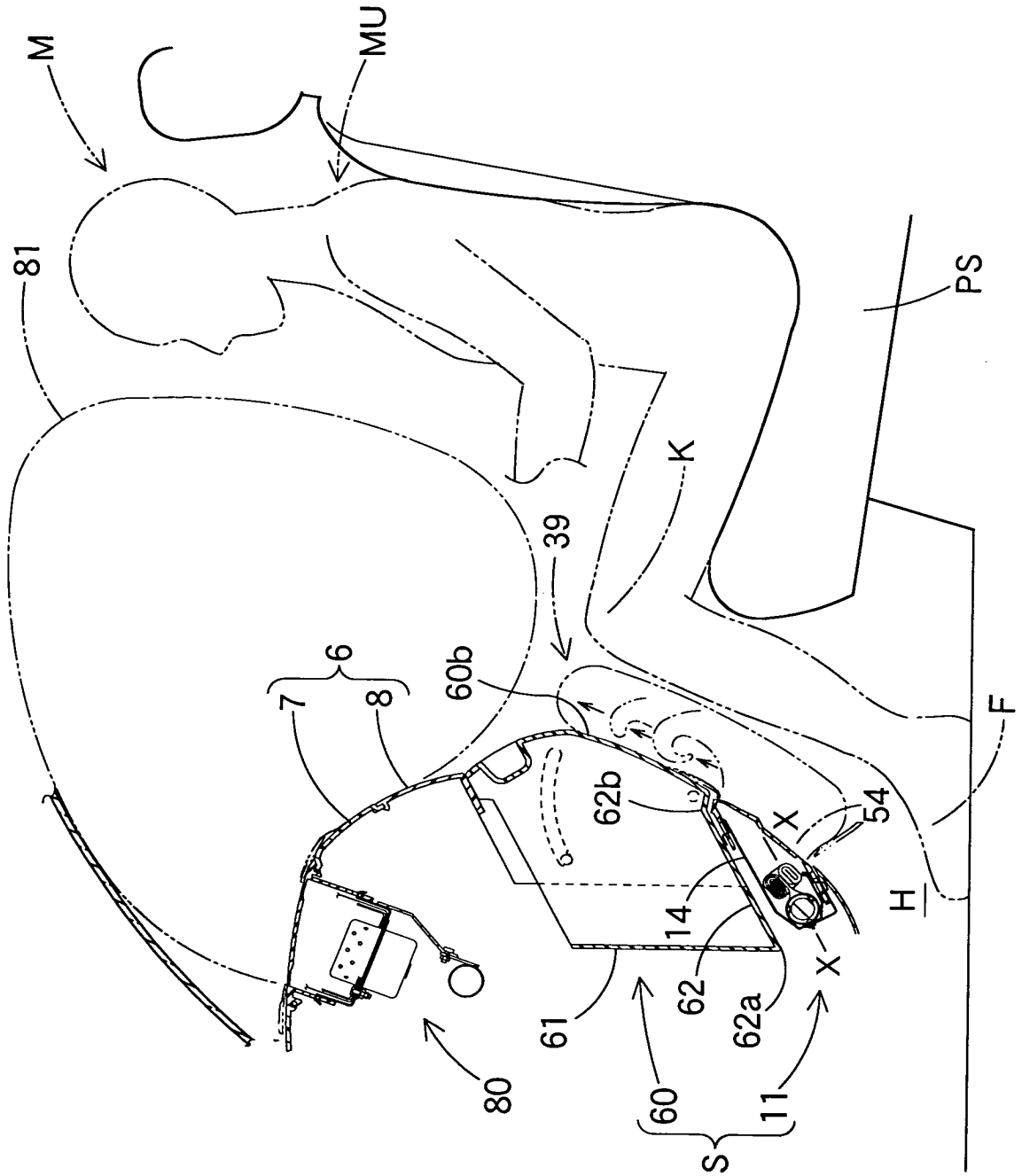


Fig. 3

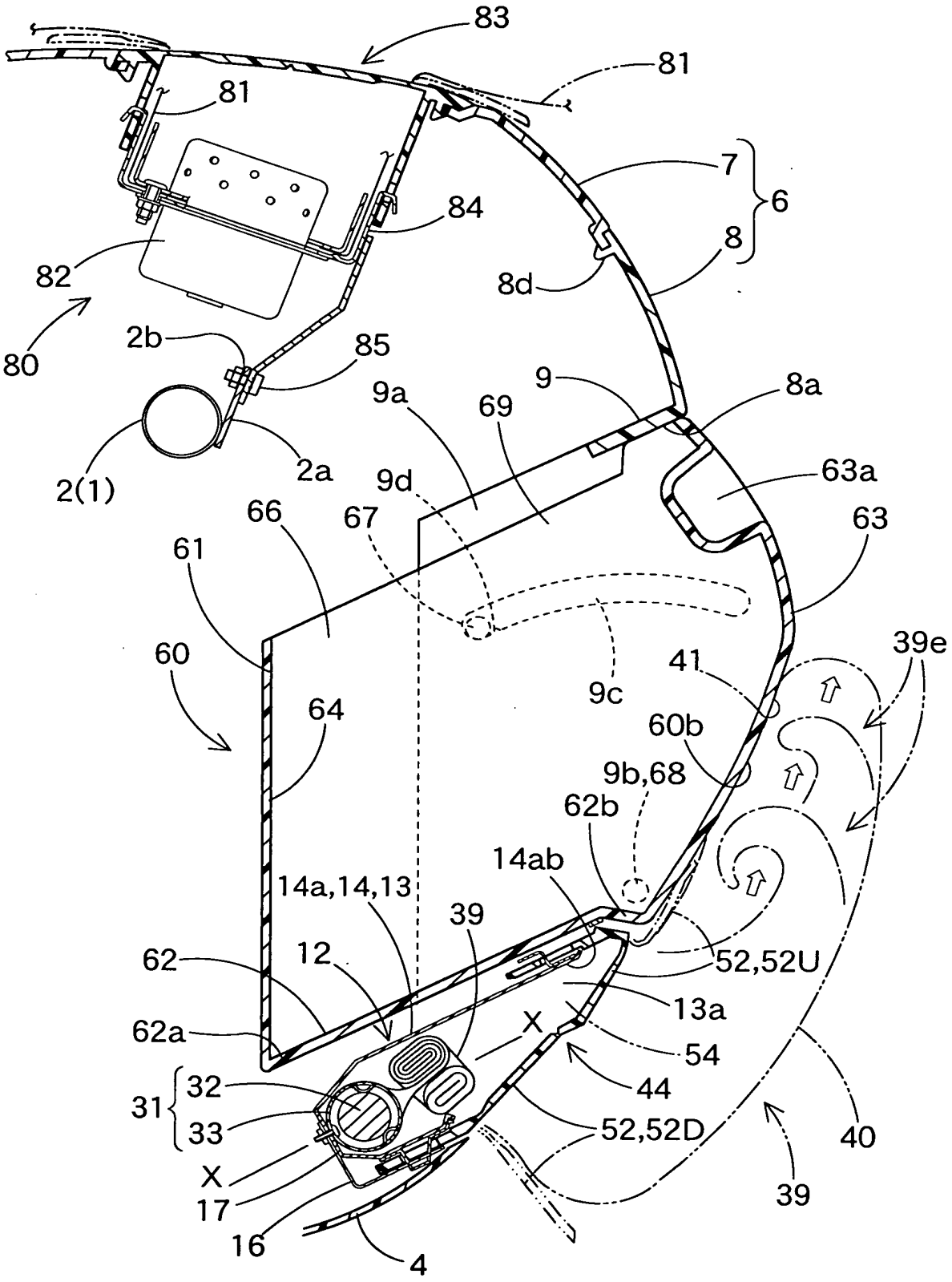
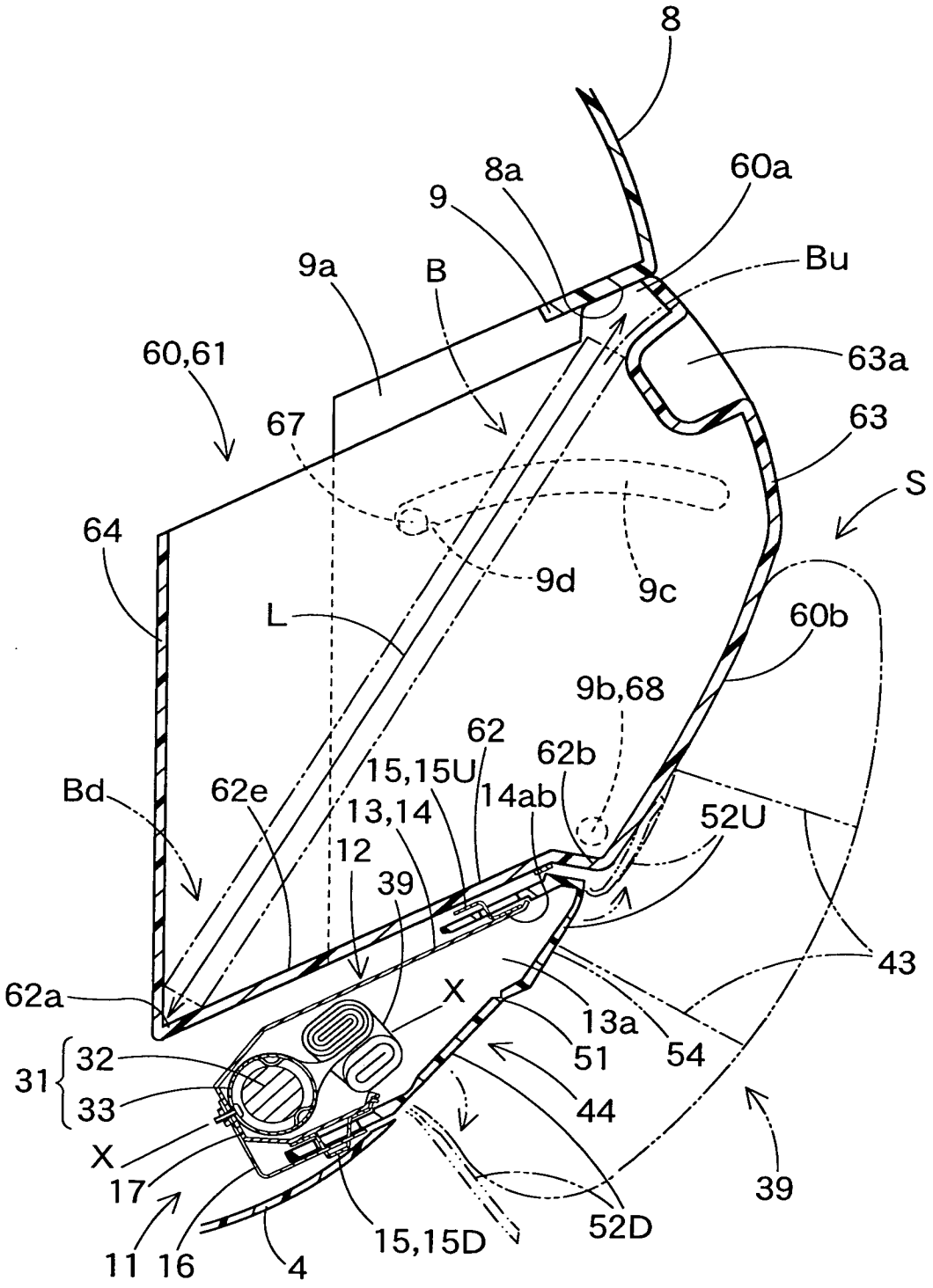

83
81
81
7
6
8
84
82
8d
80
2b
85
9
8a
9a
69
2(1)
2a
9d
63a
66
67
63
61
39e
60
41
9c
64
60b
9b,68
62b
14ab
14a,14,13
39
62
12
52,52U
13a
62a
X
54
44
31
32
33
52,52D
40
X
17
39
16
4

Fig. 4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8a
60a
9
9a
B
Bu
60,61
63a
67
63
S
64
9d
9c
L
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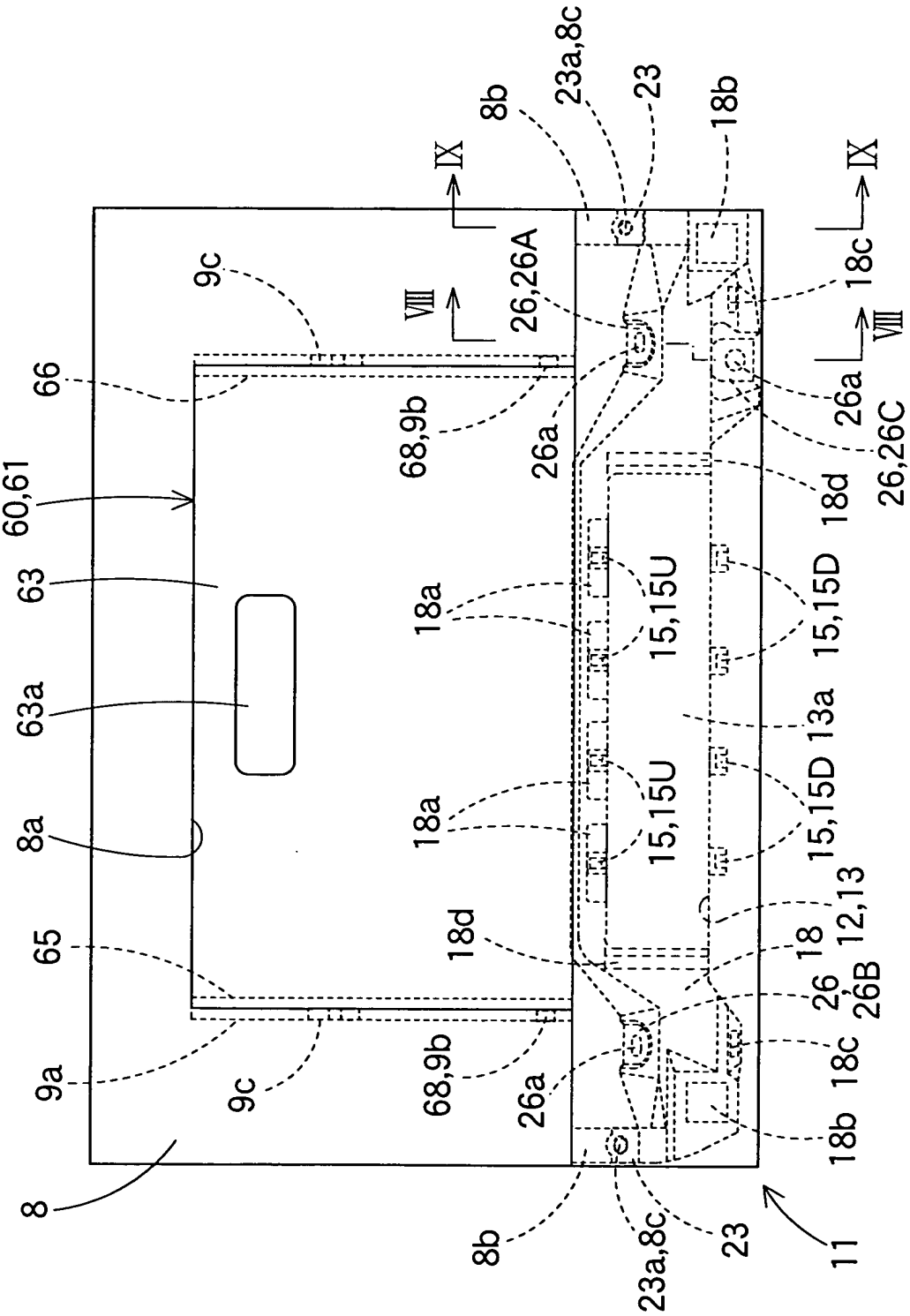
9b,68
62
62b
Bd
62e
15,15U
14ab
13,14
52U
12
39
43
62a
X
13a
51
54
31
32
33
44
X
17
39
52D
11
16
4
15,15D

Fig. 5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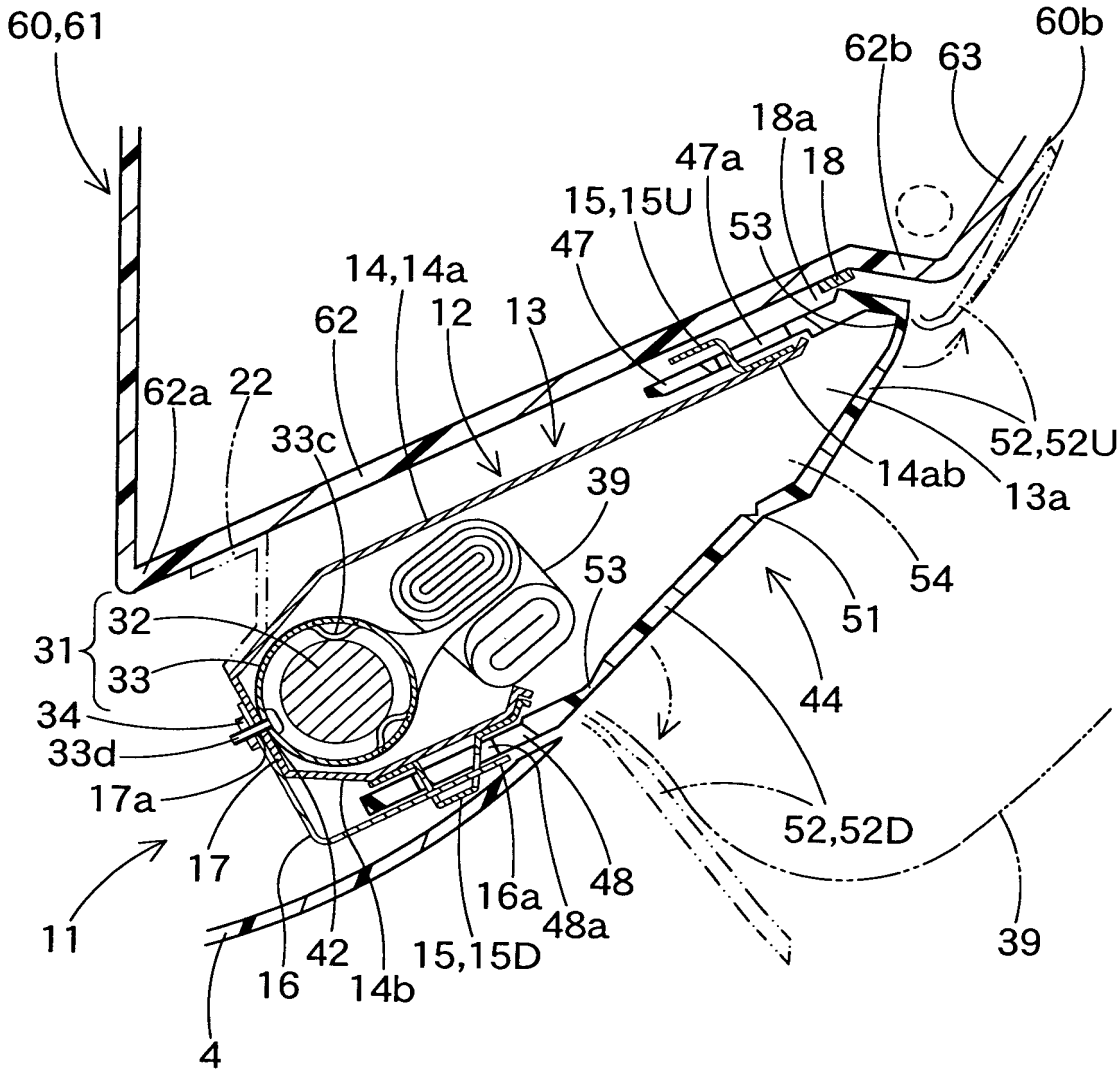
9a
65
66
9c
60,61
63
63a
8a
68,9b
26a
VIII
26,26A
IX
8b
23a,8c
23
18b
18c
26,26C
18d
18a
15,15U
15,15D
13a
12,13
18
26
26B
11

Fig. 6


60,61
62b
63
60b
18a
47a
18
15,15U
53
47
14,14a
62
12
13
62a
22
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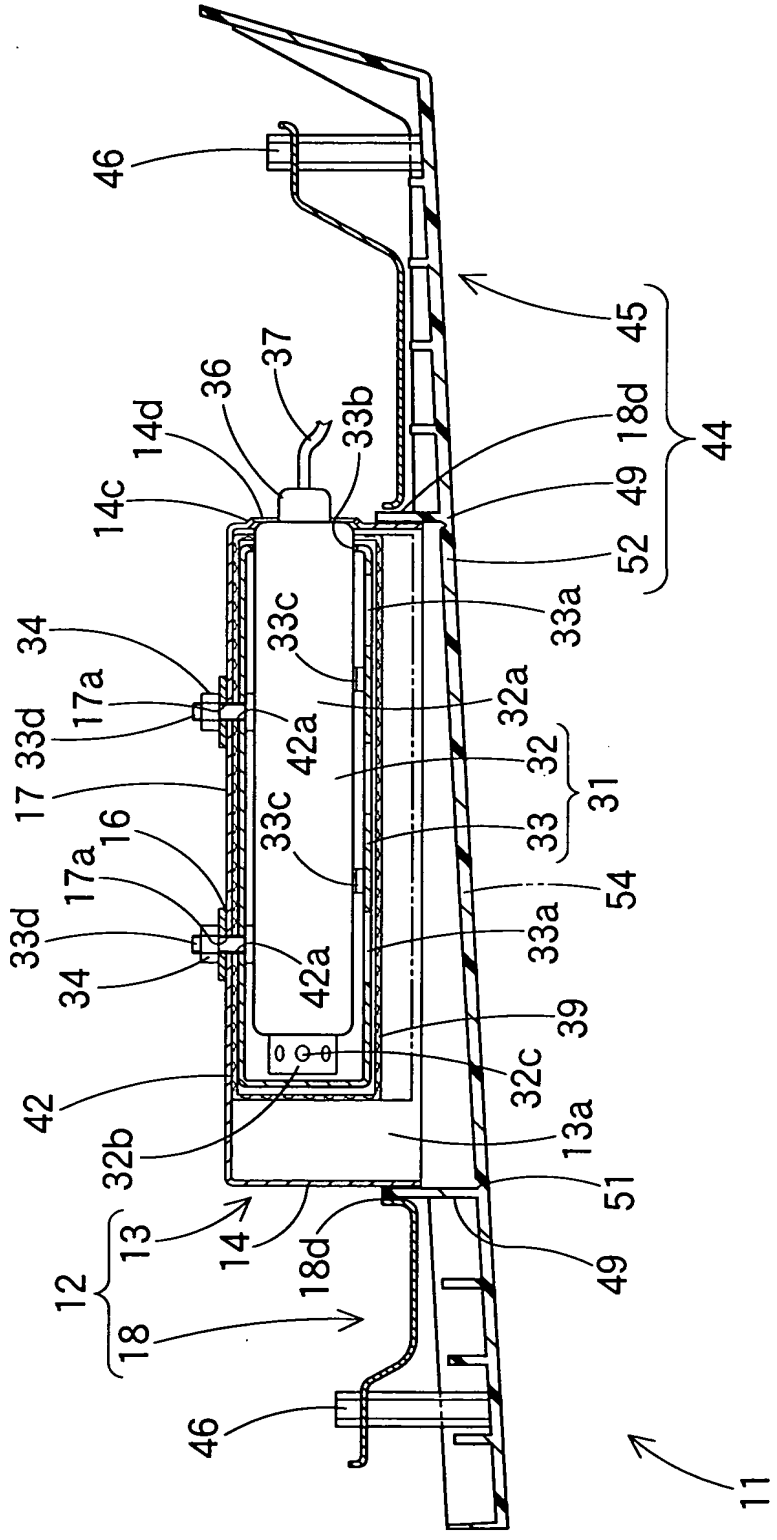
52,52U
14ab
13a
39
54
53
51
31
32
33
34
33d
17a
44
52,52D
17
11
16a
48
48a
42
15,15D
16
14b
4
39

Fig. 7


46
45
44
37
36
33b
14d
18d
14c
49
52
33a
33c
34
17a
32a
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33d
32
17
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32c
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13a
32b
51
13
14
18d
49
12
18
46
11

Fig. 8

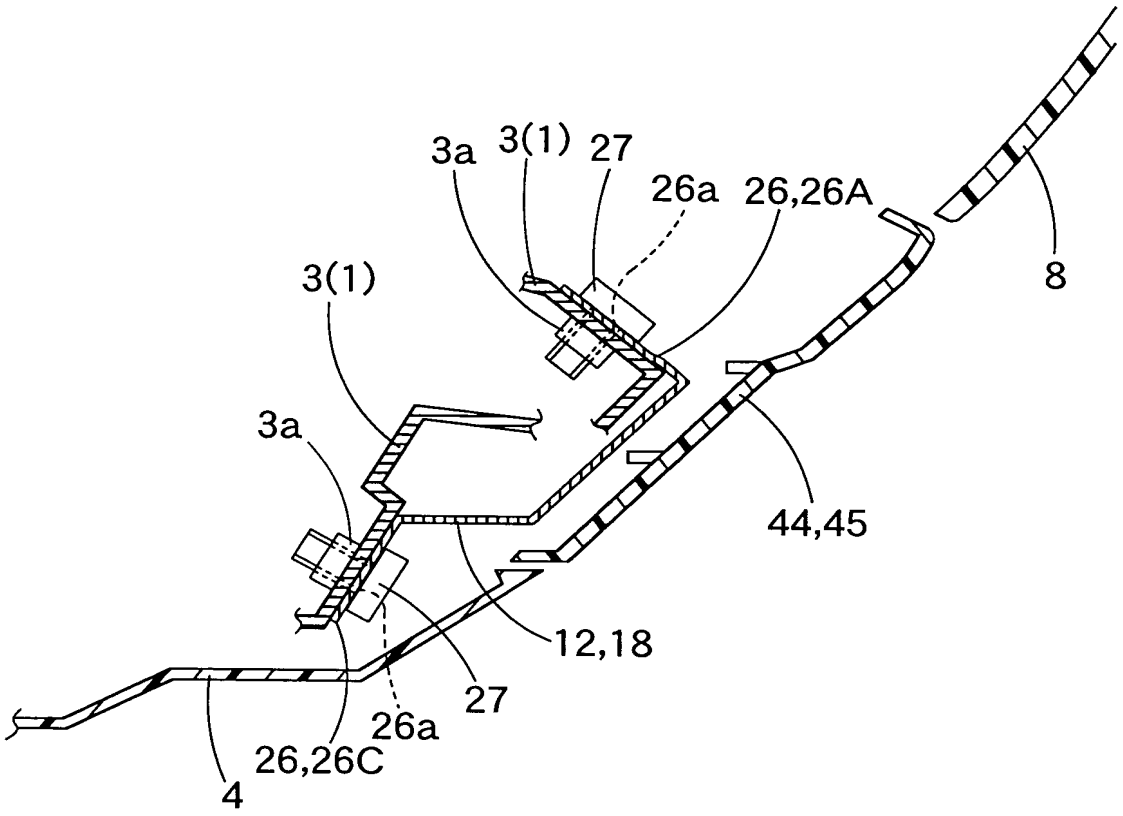


Fig. 9

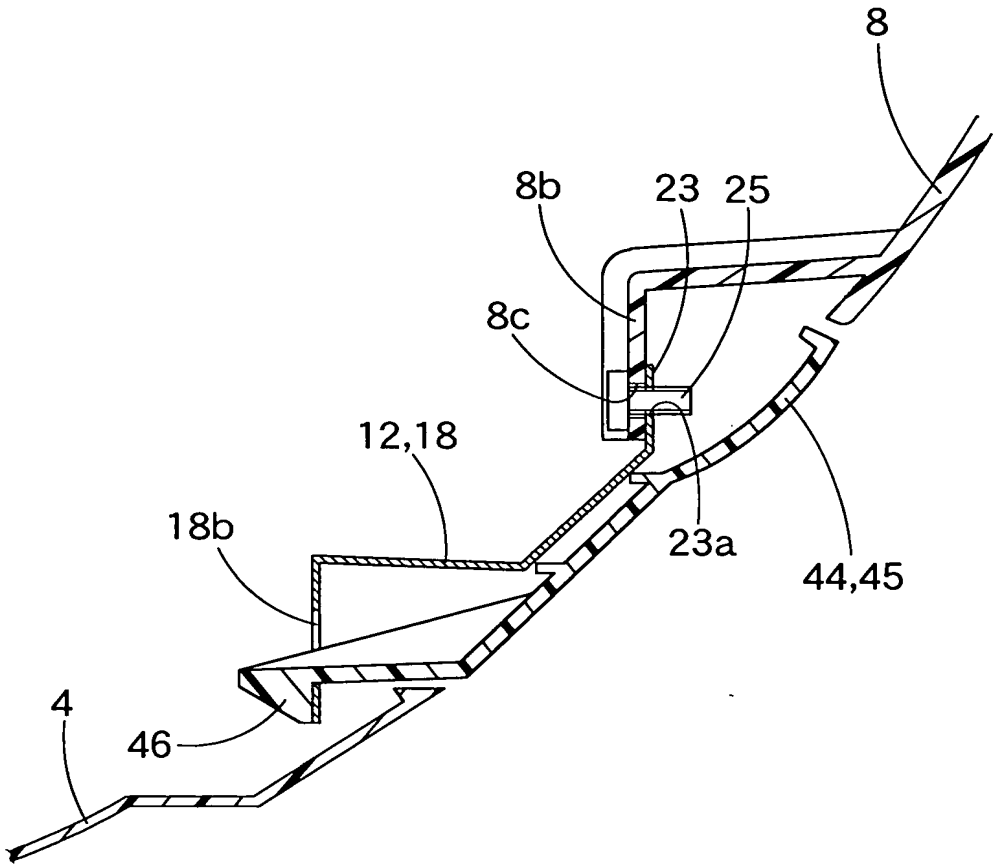
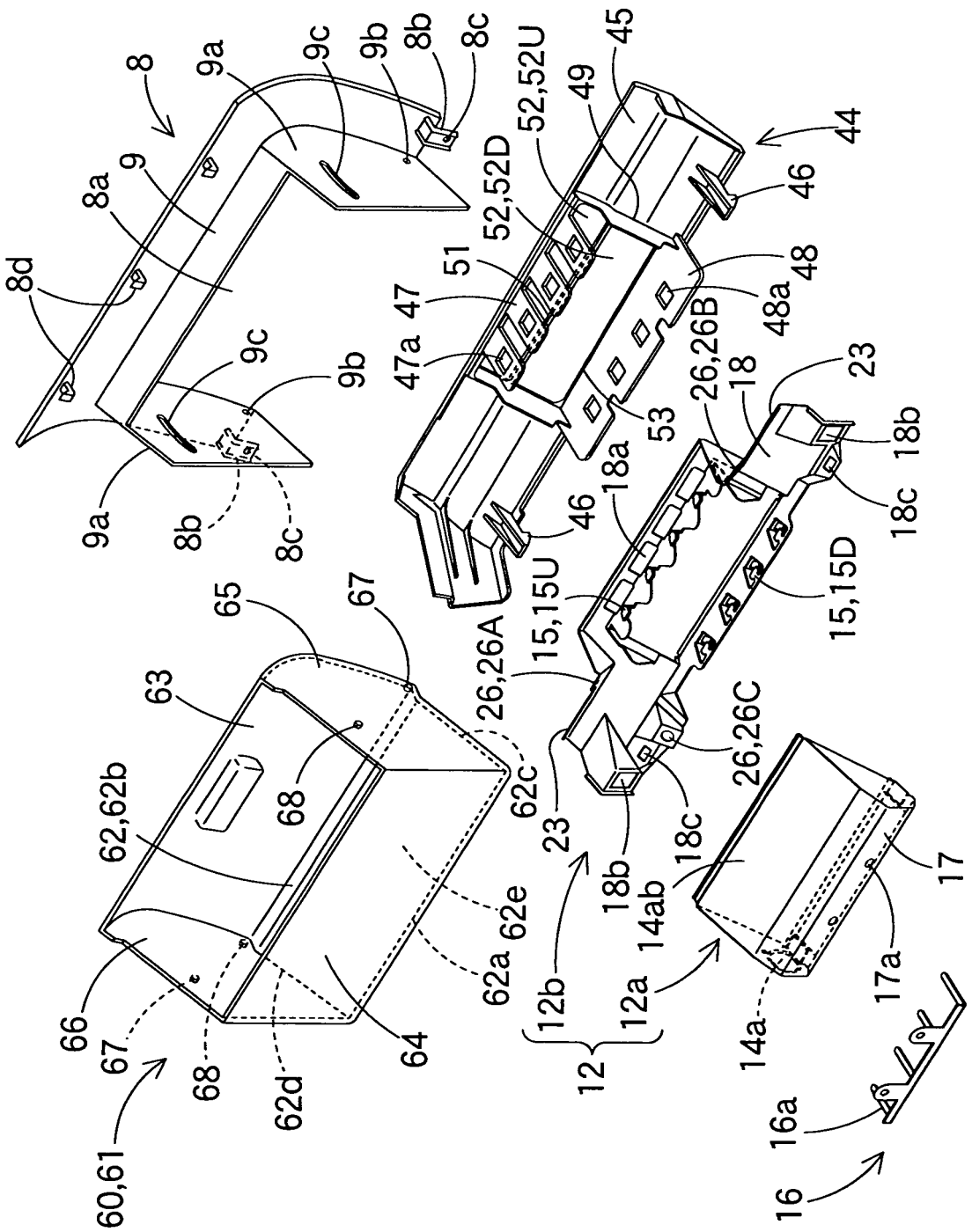


Fig. 10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9b
8b
8c
8a
9
8d
9c
9b
9a
8b
8c
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52,52U
52,52D
44
46
51
48
47
48a
47a
53
26,26B
18
23
18a
18b
18c
46
15,15U
15,15D
26,26A
65
67
63
26,26C
62,62b
68
62c
23
18b
18c
14ab
62e
62a
12b
12a
12
14a
17a
17
66
67
68
62d
64
16a
60,61
16

Fig. 11

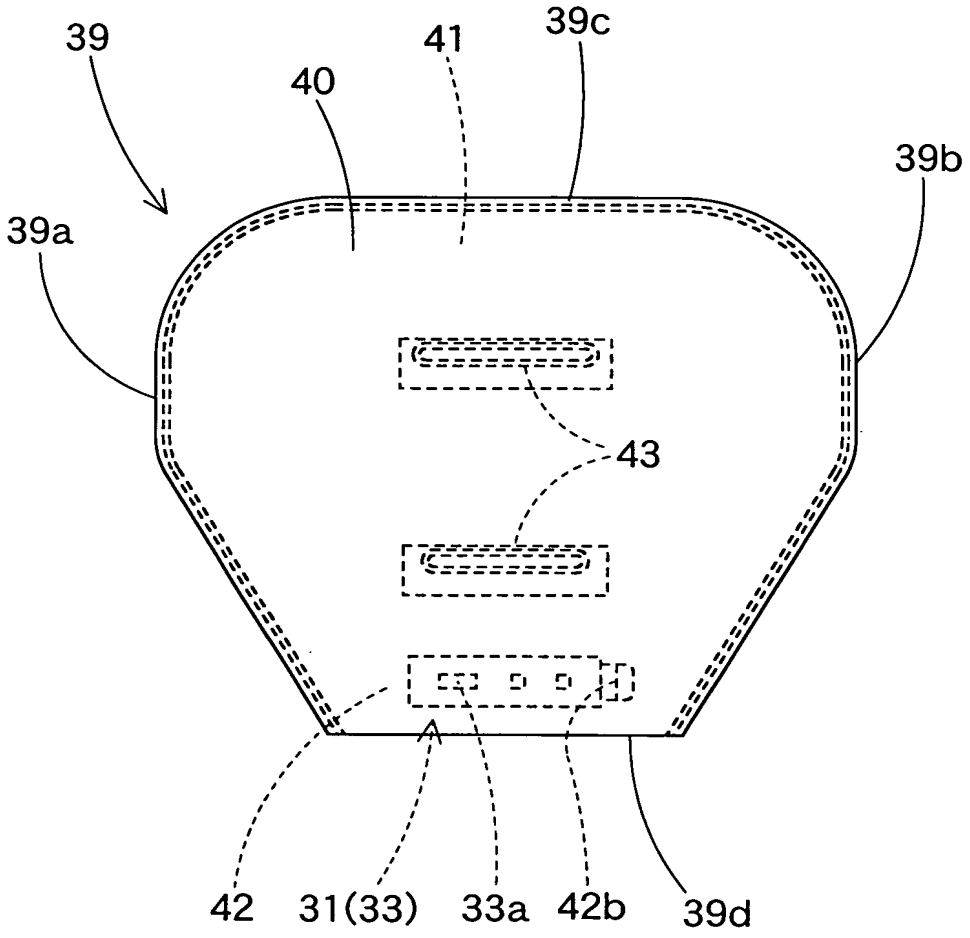


Fig. 12

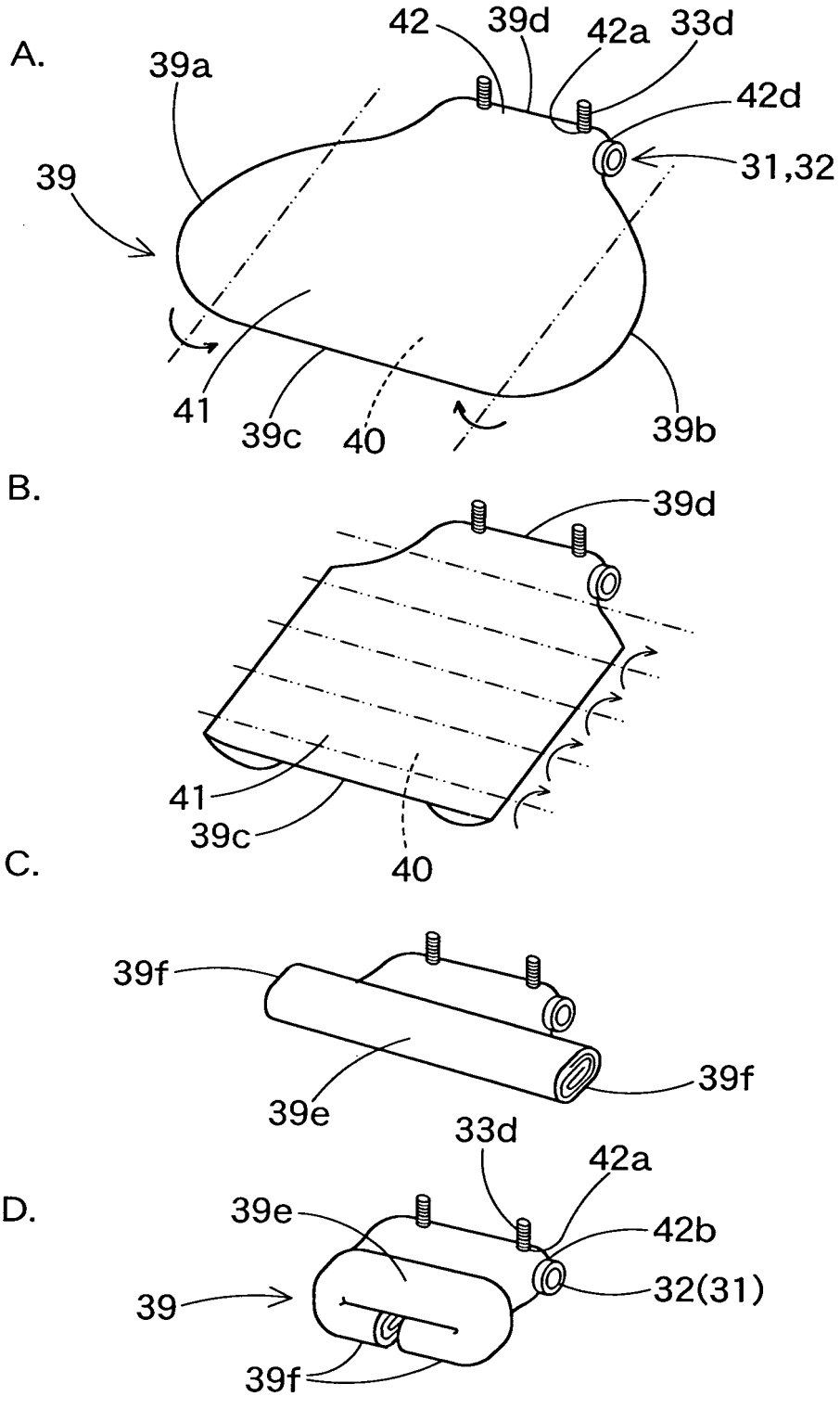

A.
42
39d
42a
33d
39a
42d
39
31,32
41
39c
40
39b
B.
39d
41
39c
40
C.
39f
39f
39e
D.
33d
42a
39e
42b
39
32(31)
39f

Fig. 13

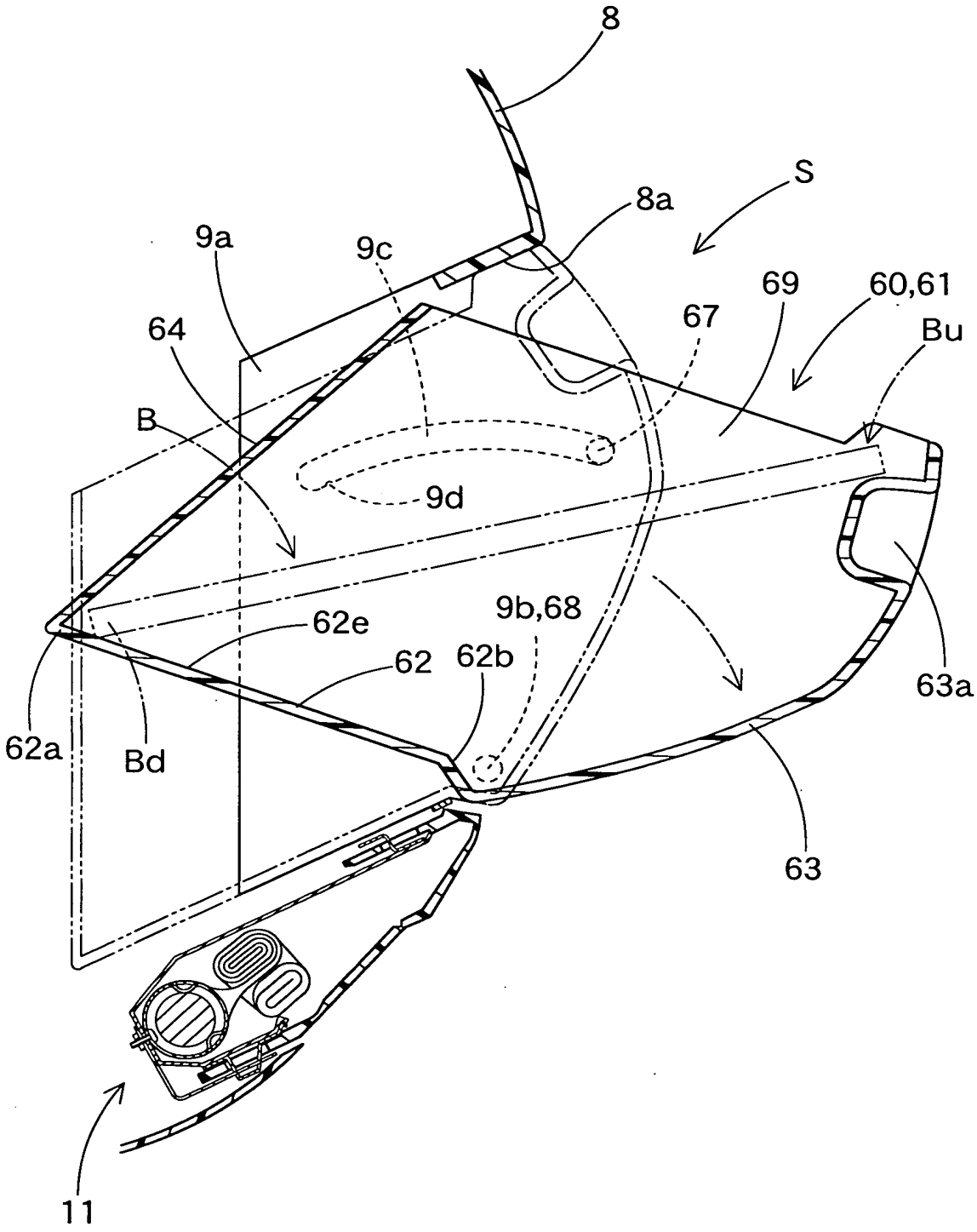


Fig. 14

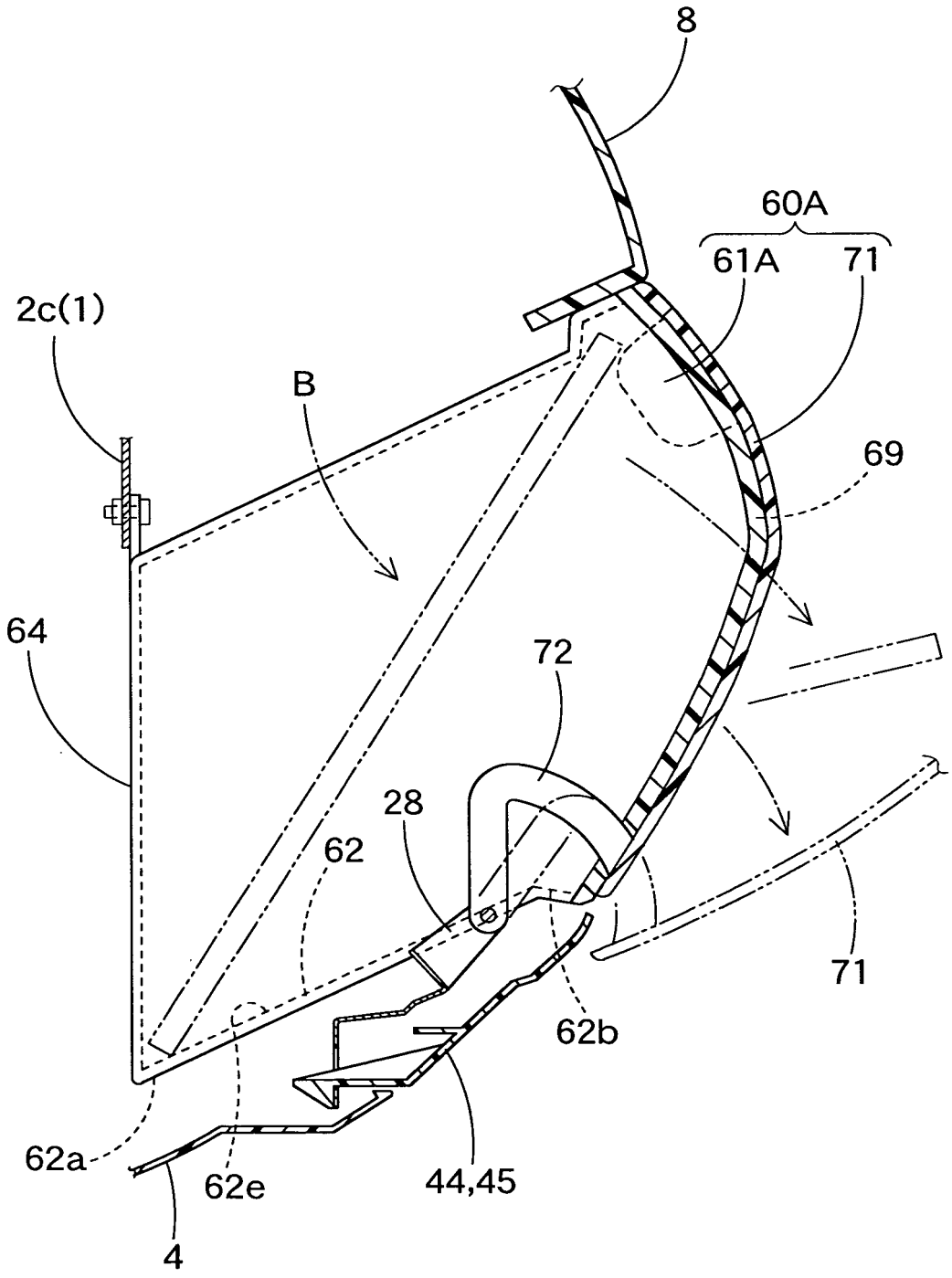
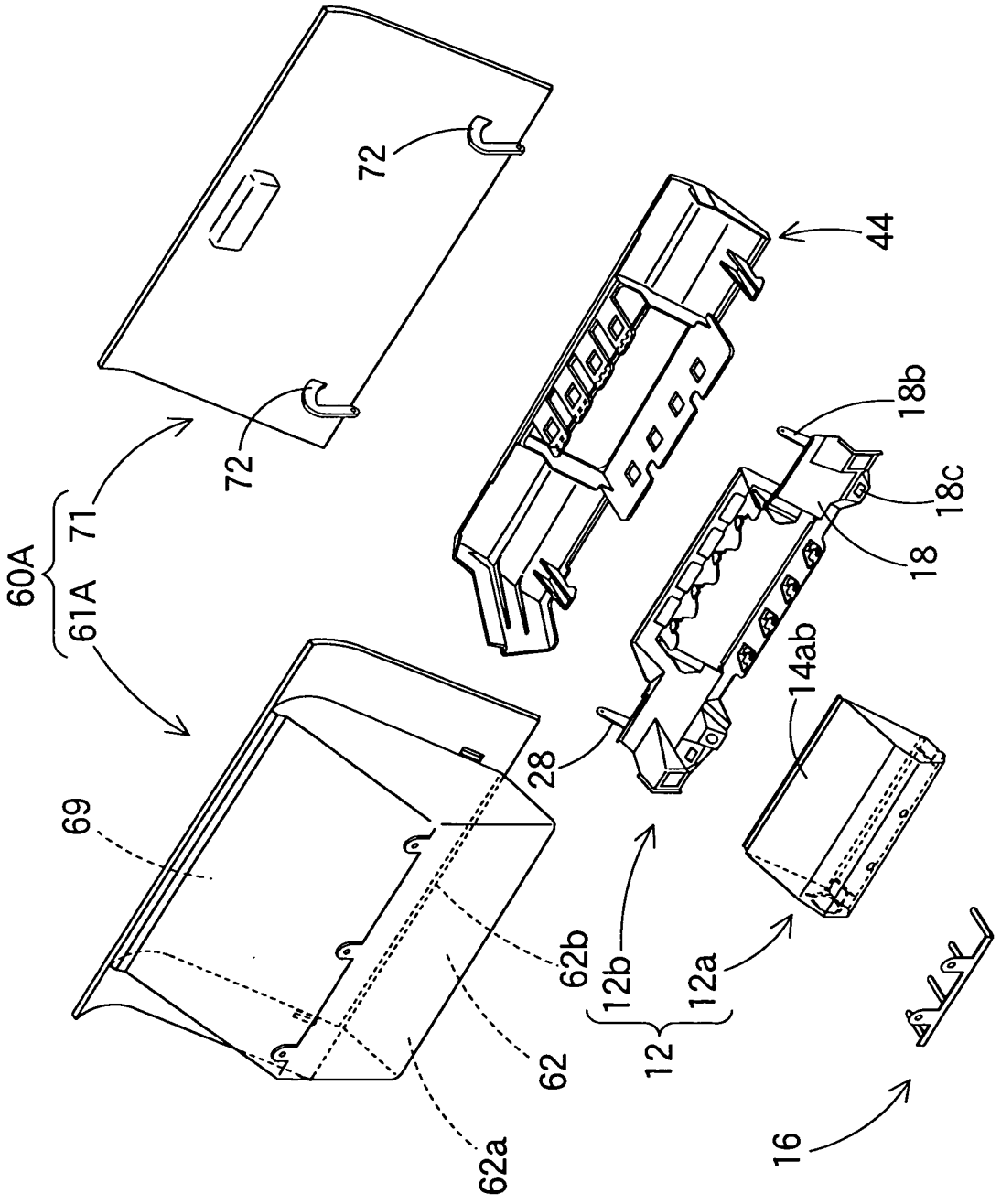


Fig. 15



[Name of the Document] Abstract of the Disclosure

[Abstract]

[Task] To provide an occupant protection device which allows the container box to have an enough housing space to house large goods even if a container box is mounted in front of the front passenger's seat while the device aims to protect knees of the occupant seated in the front passenger's seat.

[Means of Solving the Problem]

The occupant protection device S includes a knee-protecting airbag device 11 for protecting knees of a vehicle occupant seated in the front passenger's seat, and a container box 60 for housing goods B. The knee-protecting airbag device 11 has an airbag 39, an inflator 31, a case 12 for housing the airbag and the inflator and which is opened rearward, and an airbag cover 44. The container box 60 includes a bottom wall 62 to support the goods B by its top face 62e. The bottom wall 62 is slanted in such a manner as to dispose its front edge 62a in a lower level in relation to its rear edge 62b. In the case 12, the rear region 14ab of the upper wall 14 of the circumferential wall portion 14 located around the opening 13a extends along the bottom wall 62.

[Selected Drawing] Fig. 4